



USING WATER TANKS SAFELY

Planning, maintenance, early warning signs

CONTENTS

- | | | |
|----------|---|----------------|
| 1 | Water tanks - when and why
can they become a hazard | Page 3 |
| 2 | Increased safety through good planning
and professional construction | Page 4 |
| | a) Tips on buying your tank | |
| | b) The right location | |
| | c) Correct installation and initial operation | |
| 3 | Maintenance, inspection and
early warning signs during use | Page 10 |
| 4 | Gartenbau-Versicherung's
insurance coverage | Page 15 |

1. WATER TANKS – when and why can they become a HAZARD?

In recent years, Gartenbau-Versicherung has received an increasing number of claims for burst water tanks. The damage to the tank itself is usually the least of the problems. Water tanks are still a relatively inexpensive solution for ensuring that water, a primary resource for horticulture, is reliably available even during dry periods.

But time and again, bursting tanks cause enormous consequential damage. When more than 500 tons of water suddenly burst out of a tank at full force, the water masses can even destroy brick walls. Even heavy equipment such as boilers can be dislodged by the resulting forces, and expensive electronic parts can be completely destroyed. Often, standing walls and supports are also demolished, glass is shattered, there is damage to crops and extensive soiling – operations are severely disrupted or even halted completely. All this is much more expensive than the cost of the ruptured tank – not to mention the possible danger to people who may be in the vicinity at the time of the incident..

This is one of the reasons why it has been mandatory for water tanks in Dutch horticulture, for example, to be regularly inspected by specially trained contractors for several years now. As a result, the number of burst tanks has fallen from several cases per month to a maximum of one per year.

Prevention is possible - and absolutely essential!

The good news is that there are plenty of things that every user can do to ensure that his or her water silos are well protected. This not only prevents damage, but also extends their service life. This requires expert planning as well as an awareness of the fact that various risks are interrelated and may exacerbate each other. And that often very small, barely visible changes are the first signs that a tank is about to burst.



Damage to crops due to burst tank in the summer of 2022

This article on operational safety combines the practical experience of Gartenbau-Versicherung gained from many cases of damage with state-of-the-art specialist know-how. It focuses on concrete tips for the planning, purchase and construction phases, but also for day-to-day operations. Because safety can often be improved with just a few simple measures.

2. INCREASED SAFETY through GOOD PLANNING and professional construction

a) Tips on buying your tank

Water tanks are statically designed to store as much water as possible while using as little material as possible. In other words, the thin silo walls are **not optimized for a high degree of safety**. Most tanks therefore have walls that are only 0.8 - 1.2 mm thick. This corresponds approximately to a stack of 10 pages of copy paper.

As supplier merchandise, water tanks are of course subject to standards and directives, whose technical requirements are designed to ensure safety. Nevertheless, there are **variations in quality** that should be taken into account. And of course not every water tank is suitable for every business and its requirements. So what do the specialists at Gartenbau-Versicherung recommend when it comes to making a purchase?

1 Choose reputable, established suppliers or manufacturers!

They have the necessary expertise and can be relied upon to deliver the quality you need. Make sure that your supplier offers good professional advice and detailed informational material for you to consult. It is important to work together to find a good solution for your individual storage system requirements. Water quality and site conditions must also be taken into account in order to select the right sheet metal and foil materials.

2 Nutzen Sie im Freiland möglichst Tanks mit „Coating“!

Das ist ein Kunststoffüberzug, der die Korrosionsbeständigkeit erhöht. Dies gilt vor allem für die Folgen der nicht zu vermeidenden Exposition korrosiver Stoffe und die Feuchtigkeit entlang des untersten Rings.

3 Wählen Sie auch die Innenfolie / Tankfolie / Behälterfolie mit Bedacht!

Wir empfehlen vor allem die Nutzung folgender Typen:

- Standard-PVC-Folien für Regenwassernutzung
- PP-Folien, EPDM-Folien oder verstärkte PVC-Folien für physikalisch-chemisch vorbehandelte Flüssigkeiten (z. B. Rezirkulat) und die Aufstellung im Freiland

How do water tanks differ in terms of criteria?

- Tanksize, shape
- Liquid being stored (e.g. rainwater or drainage water)
- Location (indoor / outdoor, protected / unprotected, on ground level / in-ground)
- Coating (esp. corrugated metal and foil quality)
- Configurations (pipe system, valves and fittings)



b) The right location

A suitable location will increase the durability of the silo while reducing the extent of consequential damage in the event of the tank bursting. The following **recommendations** can help you select the best location:

Zones with little “traffic” are most suitable

Ideally, the water tank should be located in the zone of the business with the least „traffic“. In parts of the business in which cars and machinery are moving around, water tanks should be protected by some form of impact cushioning, such as crash barriers, bollards or concrete obstacles. In addition, the area within a radius of 2 to 3 meters around the tank should not be used as a maneuvering or parking area. If goods are frequently stored and handled there, the likelihood of accidents and unintentional contact, e.g. by the forklift fork or falling parts, increases.

Avoid extreme temperature fluctuations

Extreme heat and cold as well as temperature fluctuations can damage and deform the steel plate of the tanks. This can lead to changes in shape and size, which can cause leaks, especially at overlap joints and screw connections.

Our recommendations:

- Correct construction and sheets with alloy (hot-dip galvanized) reduce expansion.
- Indoor tanks should not be located directly next to equipment that emits heat (e.g. fan heaters)
- Tanks should not be installed in locations with significant fluctuations in temperature, such as small-sized greenhouses. The combination of cool storage liquid, highly heat-conductive metal sheets and warm, humid outdoor conditions can quickly lead to condensation



Subsoil: Dry, stable, level

Filled water tanks weigh several tons per square meter. This exerts a great deal of pressure on the base area and can quickly cause the silo to subside on one side or deteriorate prematurely due to corrosion – especially if the foundation is not strong enough, the subsoil is not properly compacted or soil is eroded. The latter occurs above ground, for example, through overflow water, and below ground through ground water or the decomposition of humus. N. B.: Tanks can only stand securely if the outer walls are exactly vertical! Only the smallest of deviations can be tolerated.

We therefore recommend:

- For open-field installation, the water tank should always be located above the groundwater table.
- If the groundwater level fluctuates considerably or if the soil is water retentive and compacted, use drainage systems. Tanks should also not be installed on permanently damp soils.

- Hollow in the ground and slopes should not be used as locations for installation.
- The suitability of the subsoil can be determined, for example, by means of an examination. Manufacturers usually stipulate that a ring wall must be laid.

Wind protection

With open-field installation, tanks should be installed behind wind-breaking elements if possible (e.g. in the wind shadow of buildings or behind windbreak hedges – at an appropriate distance for the optimum effect) to reduce damage to the tank wall and foil caused by wind.

Protect your infrastructure

To minimize the risk of business interruption, the tank should be located as far as possible from sensitive or operationally critical infrastructure (especially offices, installations rooms, etc.).

c) Correct installation and initial operation

Before you begin

Silos must also meet certain standards and comply with certain guidelines in terms of their construction. Having the silos **installed by specialist companies** usually helps to rule out avoidable errors that could significantly reduce their durability. Liability and warranty also remain valid. However, if you are planning to have the silos installed by your own staff, please observe the following **principles**:

- **Check** in advance whether all the components are complete and undamaged. **Do not install any damaged metal sheets or other materials**, as their structural stability cannot be guaranteed. Foils should also not have any holes and/or cracks.
- If any screws, washers, nuts, etc. are missing, they should of course be reordered from the **original supplier/manufacturer**.
- **Do not install any third-party components** (e.g. screws, sheet metal from other manufacturers). These could be incompatible with the static requirements of the tank system.
- Assembly should be carried out in **windless and dry weather conditions** so that parts are not damaged and the protective fleece does not become damp.



Installation

During the actual construction, the first most important thing is the **preparation of the ground**. For the tank to stand securely, you need either a sufficiently dimensioned, level base plate or a sand bed with concrete slabs to support the tank. The entire circumference of the container must fit on the slab(s) and be stable. Prior to installation, also take care of any **pipng** that needs to go through the concrete slabs or sand bed. You may also find the following tips helpful:

- The upper corrugated sheets must always be installed from the outside on top of the sheet below. This **overlapping structure** prevents rain or condensation from running along the sheets between the outer wall and the foil.
- Be sure to use the recommended **torque** for tightening the bolts to protect the thin corrugated sheets from damage and deformation.
- Foils should be installed **at temperatures above 10 °C**, as they are more brittle and more susceptible to cracking in cold conditions. When fitting the foil, contact with metal components of the silo should always be prevented by using a layer of fleece.
- The **protective fleece** should always be completely covered by the foil. This can be achieved by using appropriate belt systems or foil tensioning elements on the upper ring.

Fastening the tank

It is important that the tank is securely fastened, as the shape of water tanks installed outdoors makes them particularly vulnerable to the wind. Therefore, manufacturers recommend **embedding** them in the ground, **earthing them up** or fastening them to the ground slabs with brackets. If this is not done, partially emptied and empty tanks in particular could be dislodged and damaged by the wind. In general, we therefore also recommend **never emptying the tanks completely** or filling them up again as soon as possible.

For tanks that are embedded in the ground, **it is essential to follow the manufacturer's specifications regarding the depth**. Often the difference in height between the bottom of the tank and the surrounding ground is less than 50 cm. Tanks designed to be embedded usually have a reinforced and coated bottom ring due to the earth pressure and the more corrosive conditions. If you intend to create the difference in height at a later stage, the lateral fill must be at least 2 meters wide.

Retrofitting and spare parts

In the event of any repairs or modifications, it is essential to obtain the **parts from the original supplier/manufacturer**. This is the only way to ensure that the materials used meet the required standards.

The wall thickness of the metal sheets within a ring are calculated depending on the size of the tank. **Increasing the size of a water silo** by fitting additional rings may therefore require static reinforcement of the lower rings. Therefore, if you simply install additional rings onto a silo that is not statically designed for this purpose, you will significantly increase the risk of it bursting. However, you could buy a silo that is statically designed for this in the first place and then later increase its volume by adding rings. This allows you to remain flexible in terms of capacity.

Caution: In this case, the subsoil must also be prepared in advance for higher loads and a reinforced foundation should be built.

We strongly advise against **drilling into the metal sheets**, as this, like corrosion, weakens the metal sheets of the silo and can lead to predetermined breaking points. If an extraction pipe needs to be fed through the sheet metal of the water silo, only retrofit kits from the manufacturer should be used. These reinforce the sheet metal around the outlet.



Controlled filling

Filling water tanks should always be done in such a way as to avoid oscillation and to avoid point loads on the silo wall. Particularly with slim tanks, problems often arise if they are filled with high flow velocities, for example during heavy rain. The combination of too narrowly dimensioned lateral inlets and high inflow velocities of the deposited water leads to **high pressure loads** of several tons and the formation of eddies. These eddies cause the water silo to oscillate and the corrugated sheet walls to be subjected to uneven loads. Especially if the silo has previously been weakened, such loads can cause the silo to burst.

Gartenbau-Versicherung therefore recommends:

- choosing **large diameters** for tanks and inlets as well as
- **reducing the inflow velocity** and breaking up the stream of water.

The later can be achieved by one of the following three methods:

- Filling through **vertically positioned or obliquely cut pipe ends** - these should allow the water to flow in at least 0.5 meters from the silo wall
- Installing **water dosing hoses** at the pipe ends
- Installing the **water inlet in the middle and at the bottom** - this also helps to prevent pressure loads and the formation of eddies

Overflowing water can seriously weaken the subsoil and thus endanger the stability of the tank. So-called overflow protection systems are available for such situations. These can be an overflow siphon at the top of the silo, which drains off excess water, or a float valve on the downpipe or the pump, which stops any further water intake once it reaches a certain level in the tank.

3. MAINTENANCE, INSPECTIONS and EARLY WARNING SIGNS during use

During the usage of the tank, Gartenbau-Versicherung recommends various **methods** to increase its lifespan. The most important aspect is to **protect the tank from moisture, acids and other corrosive substances**.

a) Regular maintenance

- **Always remove acids from the tank surface immediately!** Concentrated acids (e.g. from tabletop disinfection) have a highly corrosive effect and should therefore never come into contact with the tank's metal sheets. In general, systems containing acid should ideally be installed in such a way that no concentrated acid can come into contact with the tank in the event of leakage.
- **Protect surfaces from "airborne attacks"!** Corrosive substances can also settle on the tank metal sheets via the air (e.g. fertilizer salts). At higher air humidities and air temperatures – which are particularly common in under cover cultivation – airborne contaminants such as dust, soot, sulfur dioxide, chlorides or ammonia can travel very well. Fertilizer bags in particular should therefore always be kept tightly closed. Tanks in greenhouses are therefore more susceptible to corrosion and should be inspected more frequently.
- **Keep open-field tanks well clear of vegetation!** The immediate vicinity of the tank (a radius of 1 to 2 meters) should be cleared of vegetation close to the ground once a month during the growing season or the edge layer should be covered with gravel or similar from the start in order to prevent the outer walls from permanently becoming damp.
- **Use tarpaulins/roof structures and keep them clean!** This will also prevent substances, especially biomass, from entering the tank. This prevents pipes near the ground from becoming clogged and the foil from being corroded by the decomposition products. Vegetation on the tarpaulin should be removed at least once a year.
- **Remove sedimented biological sludge from the bottom of the silo every one to two years!** If biomass enters the tank, biochemical conversion processes will occur. Over the course of a just a few weeks, biogas may develop. This results in the formation of compounds that are harmful to the foil, causing it to become porous and shrink, which can eventually lead to leaks.
- **From time to time, check whether the feed pump and other moving parts, such as the mechanical water level indicator, are functioning correctly.** You should check overflow pipes and filling tubes near the ground for blockages and clear them of any decomposing material. This should be done at least once a year, for example during the inspection.



Problems in winter

Water in outdoor stand-alone tanks can freeze during the winter months. This poses particular risks to their safety when in use, as when water is then extracted, the ice will, if it is thick enough, no longer float on top of the water but will form a kind of dome. In addition, ice may form on the tarpaulin. The weight of the ice layer in conjunction with a vacuum created by further water extraction then acts directly on the outer wall. Since the corrugated sheets are not usually designed to withstand tensile loads, the tank collapses; frozen foils also pull on the outer walls and can be severely damaged.

We therefore recommend the following:

- **Do not extract water if you are not sure that the water tank is free of ice!** Check, for example, whether there is a layer of ice on the tarpaulin or on the water surface.
- **Any significant amount of snow on a tarpaulin or roof structure must be cleared.** The sooner you do this, the better.
- **If the tank is absolutely necessary for irrigation in winter, it must be kept free of ice!** The tank should then not have been installed in hollows in the ground (cold air pockets) in the first place, but on slightly higher ground or in frost-protected infrastructure, such as a heated greenhouse.

b) Visual inspections and early warning signs

Gartenbau-Versicherung recommends inspecting water tanks at least once a year. In addition to checking whether the tank is still standing straight, the focus here is on corrosion and leaks. An important fact to be aware of: Corrosion not only develops from the outside, but also from the inside!

Internal corrosion

Permanent moisture on the inner wall of the silo, for example through exposed fleece or leaks in the foil, causes it to start rusting from the inside. This is dangerous as the metal sheets still look almost as good as new from the outside, even though the corrosion is already damaging the structural integrity of the tank.

So how can you recognize internal corrosion?

- One indicator is **vertical brownish rust streaks** on the outer wall, starting at the areas where the metal sheets overlap or at screw connections.

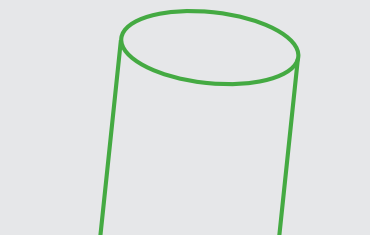
- Other than that, the tank must be emptied in order to be able to take a look at the **foil lining** and behind it.
- At the latest after seven years of operation, the **thickness of the tank walls should be measured** every two years by a specialist company. In order to do this, the tank must be freely accessible from all sides. If the foil is cracked and the corrosion inside is very advanced, it may be necessary to replace the foil and the sheet metal.

Vertical alignment check / bearing capacity of the subsoil

The tank should be checked at least once a year to verify that it is still standing straight. The water tank should be vertically perpendicular when in operation, as only the smallest deviations in the vertical alignment of the outer walls can be tolerated for structural stability. If these tolerance ranges are exceeded, a specialist company should be consulted.

Rules of thumb for vertical alignment discrepancy tolerance

- The **slimmer** the tank, the **less** discrepancy in terms of vertical alignment can be tolerated.
- If the diameter is **smaller** than the height, the discrepancy must be **less** than 3% - otherwise **less** than 5%.



Discrepancy max. 3 %



Discrepancy max. 5 %



Practical example: How to evaluate and calculate the vertical alignment discrepancy

1

A water tank is 3.5 meters high and has a diameter of 3 meters.

Height 3.5 meters > diameter 3.0 meters
 ➔ Discrepancy must be less than 3%!

2

During the annual measurement check, it becomes apparent that the height of the tank at the lowest point is only 3.4 meters, while at the highest point it continues to be 3.5 meters.

3

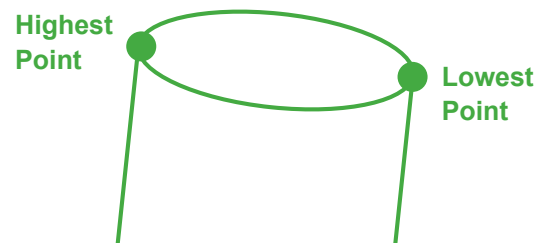
How can the discrepancy be measured in percent?

$$\frac{\text{Highest Point} - \text{Lowest Point}}{\text{Diameter}} \times 100 \%$$

In our example:

$$\frac{3.5 \text{ m} - 3.4 \text{ m}}{3 \text{ m}} \times 100 \% = 3.33 \%$$

➔ **This discrepancy is critical! The business should immediately consult a specialist company!**





It is essential to react quickly if your water tank is in danger of bursting!

Are you worried that your tank is in danger of bursting? For example, due to increasing leaks, corrosion-related cracks in the sheet metal or a critical discrepancy in terms of vertical alignment?

Then you need to react quickly:

- **Empty your tank immediately!**
- **Consult a specialist company!**
- **Do not use any makeshift or creative emergency securing devices!** We strongly advise you not to use straps or similar to secure the tank; lashing straps are not designed for such loads and their ratchets may slice into the thin metal sheet.



4. Gartenbau-Versicherung's **INSURANCE** **COVERAGE**

Despite all these precautions, water tanks can still cause significant damage. It therefore makes sense to include them in your insurance cover. In general, both the water tanks themselves and the damage to crops and to facilities and equipment resulting from an accident can be covered.

Please note: The possible consequential damage to crops and business operations is severe. Using water tanks is therefore one more reason to make sure that you have adequate insurance coverage for your crops, buildings, and equipment, and that you always keep it up to date.



Gartenbau-Versicherung VVaG

Von-Frerichs-Straße 8
D-65191 Wiesbaden

Telephone: +49 611 5694-0
Telefax: +49 611 5694-140
E-Mail: service@gevau.de
www.gartenbau-versicherung.com

An AgroRisk Group company

Autor: Achmed El-Etri

Achmed El-Etri is a scholarship holder at Gartenbau-Versicherung during his master's studies at Osnabrück University of Applied Sciences. He is a trained ornamental plant horticulturist, then worked in pomiculture before obtaining his Bachelor of Science degree in applied plant biology (horticulture, plant technology). This article on operational safety was developed during an extensive project in cooperation with managers and technical experts from the Gartenbau-Versicherung insurance company.

Images: Gartenbau Versicherung, Shutterstock
© **Gartenbau Versicherung VVaG 10/2022**